



## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Appl. No. : 10/091,237  
 Applicant : Su et al.  
 Filed : March 4, 2002  
 TC/A.U. : Art Unit: 2176  
 Examiner : Stevens, R.  
 Attorney :  
 Docket No. : 10013661-1  
 Customer No.:

Confirmation No.  
 7188

For: METHOD AND SYSTEM OF  
 DOCUMENT TRANSFORMATION  
 BETWEEN A SOURCE  
 EXTENSIBLE MARKUP  
 LANGUAGE (XML) SCHEMA  
 AND A TARGET XML SCHEMA

Commissioner for Patents  
 P.O. Box 1450  
 Alexandria, VA 22313-1450

DECLARATION OF PRIOR INVENTION IN THE UNITED  
STATES TO OVERCOME CITED PATENT (37 C.F.R. § 1.131)

Sir:

My name is Harumi Anne Kuno. I am an inventor of the subject matter of the above-identified Patent Application.

The declaration made hereof is to establish completion of the invention in this Application in the United States, at a date prior to November 5, 2001, that is the earliest publication date of the paper "Induction of Integrated View

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 Serial No.: 10/091,237

Page 1 Examiner: Stevens, R.  
 Art Unit: 2176

for XML Data with Heterogeneous DTDs," by Jeong et al. which was recently cited by the US Patent Examiner in prosecution of the present Application.

Below stated are the activities regarding the date on which the invention in the present Application was conceived and the date on which the invention was reduced to practice.

#### Conception Date

The present invention was conceived at least as early as March 15, 2001. A copy of a cover sheet on the HP Invention Disclosure Form for the present Application is presented in Exhibit A with a received date of March 19, 2001. The HP Invention Disclosure Form of Exhibit A is directed to the discovery of transformation operations between two XML schemas of the present Application. In addition, a copy of the signature page for the HP Invention Disclosure Form of Exhibit A illustrates signatures of the inventors indicating that I, Harumi Anne Kuno, am an inventor is offered in Exhibit B.

In addition, a copy of the signature page for witnesses for the HP Invention Disclosure Form of Exhibit A illustrating a signature of a witness, Umeshwar Dayal,

dated as early as March 15, 2001 is offered in Exhibit B. The witness signature is from the same HP Invention Disclosure Form of Exhibit A that was signed by the inventors, thereby demonstrating that the reduction to practice occurred at least as early as March 15, 2001.

#### Reduction to Practice Date

The present invention was reduced to practice at least as early as March 15, 2001. A copy of the first page of the description of the invention from the HP Invention Disclosure Form of Exhibit A showing that the present invention was reduced to practice is offered as Exhibit C. The first page is from the same HP Invention Disclosure Form that was signed by the witness, Umeshwar Dayal, as early as March 15, 2001 (see Exhibit B), thereby demonstrating that the reduction to practice occurred at least as early as March 15, 2001.

#### Diligence

Applicants were diligent, from the time of conception up to the filing date of the present Application.

Declaration

I, Harumi Anne Kuno, hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application of any patent issued thereon.

Dated: April 22, 2005

Harumi Anne Kuno KS  
Signature

Harumi Anne Kuno  
10301 Vicksburg Drive  
Cupertino, CA 95014



Exhibit A

COPY OF HP INVENTION DISCLOSURE COVER PAGE

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# INVENTION DISCLOSURE

PDNO

1001364

DATE RCVD

3/19/01

PAGE ONE OF

ATTORNEY TKL/STL

**Instructions:** The information contained in this document is **COMPANY CONFIDENTIAL** and may not be disclosed to others without prior authorization. Submit this disclosure to the HP Legal Department as soon as possible. No patent protection is possible until a patent application is authorized, prepared, and submitted to the government.

**Descriptive Title of Invention:**

Discovery of Transformation Operations between Two XML's Schemas

**Name of Project:**

**Product Name or Number:**

Was a description of the invention published, or are you planning to publish? If so, the date(s) and publication(s):

Was a product including the invention announced, offered for sale, sold, or is such activity proposed? If so, the date(s) and location(s):  
No.

Was the invention disclosed to anyone outside of HP, or will such disclosure occur? If so, the date(s) and name(s):  
No

*If any of the above situations will occur within 3 months, call your IP attorney or the Legal Department now at 1-898-4919 or 970-898-4919.*

Was the invention described in a lab book or other record? If so, please identify (lab book #, etc.)

No.

Was the invention built or tested? If so, the date:

Yes. 3/2001

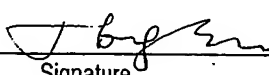
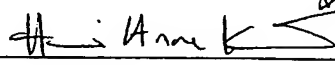
Was this invention made under a government contract? If so, the agency and contract number:

No.

**Description of Invention:** Please preserve all records of the invention and attach additional pages for the following. Each additional page should be signed and dated by the inventor(s) and witness(es).

- A. Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; samples; graphs; flowcharts; computer listings; test results; etc.)
- B. Advantages of the invention over what has been done before.
- C. Problems solved by the invention.
- D. Prior solutions and their disadvantages (if available, attach copies of product literature, technical articles, patents, etc.).

**Signature of Inventor(s):** Pursuant to my (our) employment agreement, I (we) submit this disclosure on this date: [ ]

573321	Hong Su		650 857 7206			HPL / STL
Employee No.	Name	Signature	Telnet	Mailstop		Entity & Lab Name
493701	Harumi Anne Kuno		857-3228	1U-14		HPL / STL
Employee No.	Name	Signature	Telnet	Mailstop		Entity & Lab Name
	Elke Angelika Rundensteiner					
Employee No.	Name	Signature	Telnet	Mailstop		Entity & Lab Name
Employee No.	Name	Signature	Telnet	Mailstop		Entity & Lab Name

(If more than four inventors, include additional information on another copy of this form and attach to this document)



Exhibit B

COPY OF WITNESS SIGNATURE PAGE

FOR THE

HP INVENTION DISCLOSURE

SHOWING DATED SIGNATURES AS EARLY AS

MARCH 15, 2001

Write in Dark Ink on Front Side Only, Please

INVENTION DISCLOSURE		COMPANY CONFIDENTIAL	PAGE ____ OF ____
<b>Signature of Witness(es):</b> <i>(Please try to obtain the signature of the person(s) to whom invention was first disclosed.)</i>			
The invention was first explained to, and understood by, me (us) on this date: [ 14 March 2001 ]			
Full Name	Signature	Date of Signature	
UMESHWAR DAYAL	<i>Umeshwar Dayal</i>	15 March 2001	
Full Name	Signature	Date of Signature	

**Inventor & Home Address Information:** *(If more than four inventors, include addl. information on a copy of this form & attach to this document)*

Inventor's Full Name			
Hong Su			
Street			
1 Mount Hope Terrace, Apt #3			
City	State	Zip	
Worcester	MA	01602	
Do you have a Residential P.O. Address? P.O. BOX	City	State	Zip
No			
Greeted as <i>(nickname, middle name, etc.)</i>		Citizenship	
		P. R. China	

Inventor's Full Name			
Harumi Anne Kuno			
Street			
10301 Vicksburg Drive			
City	State	Zip	
Cupertino	CA	95014	
Do you have a Residential P.O. Address? P.O. BOX	City	State	Zip
No			
Greeted as <i>(nickname, middle name, etc.)</i>		Citizenship	
		United States	

Inventor's Full Name			
Elke Angelika Rundensteiner			
Street			
107 Hosmer Street			
City	State	Zip	
Acton	MA	01720	
Do you have a Residential P.O. Address? P.O. BOX	City	State	Zip
No			
Greeted as <i>(nickname, middle name, etc.)</i>		Citizenship	
		German	

Inventor's Full Name			
Street			
City	State	Zip	
Do you have a Residential P.O. Address? P.O. BOX	City	State	Zip
Greeted as <i>(nickname, middle name, etc.)</i>		Citizenship	

Exhibit  
"B"



Exhibit C

COPY OF PAGE 11

FROM

INVENTION DISCLOSURE FORM

SHOWING REDUCTION TO PRACTICE

**A. Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; samples; graphs; flowcharts; computer listings; test results; etc.)**

This invention proposes a methodology for discovering semantic relationship between two XML schemas. We first define a data model, *element tree*, for an XML schema and introduce a set of transformation operations on the data model. We also define a cost model for the operations (see related invention disclosure). Then we propose an algorithm for discovering a sequence of operations that transform an XML schema to another XML schema.

- **Data Model.**

An XML schema is composed of a list of element type declarations. We model each element type declaration as a tree, denoted as  $T = (N, p, l)$ , where  $N$  is the set of nodes,  $p$  is the parent function representing the parent relationship between two nodes, and  $l$  is the labeling function representing a node's properties.  $N$  contains two types of nodes: *tag nodes* (nodes that represent XML document tags) and *constraint nodes* (nodes that capture relationships between the tags in XML document).

There are two types of tag nodes: *element nodes*, each of which is associated with an element type  $ET$ , and *attribute nodes*, each of which is associated with an attribute type  $AT$ . We have also identified two types of *constraint nodes*: *list node*, which represents a connector for associating other nodes to a content particle (by either sequence or choice); and *quantifier node*, which serves as a connector that indicates the number of times a child node can occur in a parent node.

A tree rooted at a node of element type  $ET$  is called *ET's type declaration tree*. For example, if  $R$  were a root element type of all XML documents conforming to a given schema, we would call  $R$ 's type declaration tree a *schema tree*.

- **Transformations.**

We then introduce a set of transformations on the element trees:

1. **Add( $T, n$ ):** Add a new subtree  $T$  under node  $n$ . This corresponds to adding a new content particle to an existing content model.
2. **Insert( $n, p, C$ ):** Insert a new node  $n$  under node  $p$  with  $n$  a quantifier node or a sequence list node.  $C$ , a subset of  $p$ 's children, now become  $n$ 's children. If  $n$  is a quantifier node, it corresponds to changing the occurrence property of a set of nodes  $C$  in  $p$ 's content model from *exactly once* to the one represented by  $n$ ; if  $n$  is a sequence list node, the semantics are to put the nodes  $C$  in a group.
3. **Delete( $T$ ):** This is the reverse operation of **Add**.
4. **Remove( $n$ ):** This is the reverse operation of **Insert**.
5. **Relabel( $n, l, l'$ ):** Change node  $n$ 's original label  $l$  to  $l'$ .
6. **Unfold( $T, \langle T1, T2, \dots, Ti \rangle$ ):** Replace a subtree  $T$  with a sequence of subtrees  $T1, T2, \dots, Ti$  where  $T1, T2, \dots, Ti$  share the same parent. This corresponds to explicitly expressing a repeatable content particle in the format of a sequence of non-repeatable content particles.
7. **Fold( $\langle T1, T2, \dots, Ti \rangle, T$ ):** This is the reverse operation of **Unfold**.

We then apply the *MatchPropagate* algorithm listed in Figure 1 to the roots of two schema trees which produces a sequence of operations that transform the source tree into the target tree.

*MatchPropagate( $n1, n2$ )* produces a transformation script that transform the subtree rooted at  $n1$  and  $n2$ . The cost of the transformation script is called the cost of matching  $n1$  and  $n2$ .

Our matching process is done in two passes. In the first pass, we traverse the direct children of  $n1$  in a certain order and try to find a matching partner for it among  $n2$ 's descendants. In pass 2, we visit those unmatched direct child nodes of  $n1$  again. We have stricter criteria for matching the nodes in pass 1 than those in pass 2. The intuition is that, in the first pass, we manage to discover high quality matches (the matches associated with a relatively low cost). In the second pass we also allow loose matches (the matches associated with relatively higher cost).

- **Match Propagate Algorithm.**

Exhibit  
"C"